Green Remediation: Maximizing the Benefit of Site Cleanups

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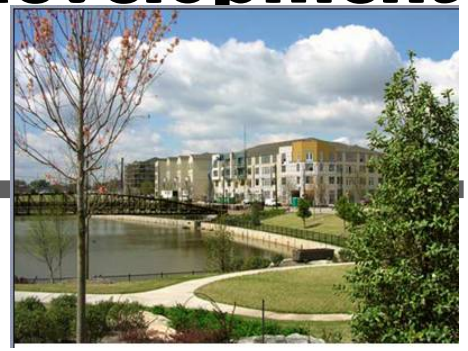
Green Approaches in Cleanup & Redevelopment



Deconstruction, Demolition, and Removal

- Reuse/recycle deconstruction and demolition materials
- Reuse materials on site whenever possible
- Consider future site use and reuse existing infrastructure
- Preserve/Reuse Historic Buildings
- Use clean diesel and low sulfur fuels in equipment and noise controls for power generation
- Retain native vegetation and soils, wherever possible
- Protect water resources from runoff and contamination

Cleanup, Remediation, and Waste Management

- Power machinery and equipment using clean fuels
- Use renewable energy sources, such as solar, wind, and methane to power remediation activities
- Improve energy efficiency of chosen remediation strategies
- Select remediation approaches, such as phytoremediation, that reduce resource use and impact on air, water, adjacent lands, and public health
- Employ remediation practices that can restore soil health and ecosystems and, in some cases, sequester carbon through soil amendments and vegetation

Design and Construction for Reuse

- Use Energy Star, LEED, and GreenScapes principles in both new and existing buildings
- Reduce environmental impact by reusing existing structures and recycling industrial materials
- Incorporate natural systems to manage stormwater, like green roofs, landscaped swales, and wetlands
- Incorporate Smart Growth principles that promote more balanced land uses, walkable neighborhoods, and open space
- Create ecological enhancements to promote biodiversity and provide wildlife habitat and recreation

Sustainable Use and Long Term Stewardship

- Reduce use of toxic materials in manufacturing, maintenance, and use of buildings and land
- Minimize waste generation, manage waste properly, and recycle materials used/generated
- Maintain engineering and institutional controls on site where waste is left in place
- Reduce water use by incorporat-ing water efficient systems and use native vegetation to limit irrigation
- Maximize energy efficiency and increase use of renewable energy
- Take appropriate steps to prevent (re)contamination

What is Green Remediation?

The practice of considering all environmental effects of a cleanup during each phase of the process, and incorporating strategies to maximize net environmental benefit of the cleanup.

Focus is on remedy implementation vs. remedy selection

Is it Our Job?

- **Executive Order 13423, January 26, 2007-Strengthening Federal Environmental, Energy, and Transportation Management**
  - » Section 1. Policy. It is the policy of the United States that Federal agencies conduct their environmental, transportation, and energy-related activities under the law in support of their respective missions in an environmentally, economically and fiscally sound, integrated, continuously improving, efficient, and sustainable manner.
- **EPA Strategic Plan Goal 1: Clean Air and Global Climate Change**
  - » Protect and improve the air so it is healthy to breathe and risks to human health and the environment are reduced. Reduce greenhouse gas intensity by enhancing partnerships with businesses and other sectors.
- **EPA Strategic Plan Goal 5: Compliance and Environmental Stewardship**
  - » Stewards of the environment recycle wastes to the greatest extent possible, minimize or eliminate pollution at its source, conserve natural resources, and use energy efficiently to prevent harm to the environment or human health.

Opportunities to Increase Sustainability in Site Cleanups

- Apply to all cleanup programs
- Exist throughout site investigation, design, construction, operation, and monitoring
- Address core elements

Core Elements: Air Emissions

- Optimal use and proper maintenance of heavy equipment
- Use of cleaner fuel and retrofit diesel engines for heavy equipment
- Modified operations to reduce operating and idle time
- Minimized dust export of contaminants

Core Elements: Water Requirements and Resources

- Minimum fresh water use and maximum reuse during treatment and site operations
- Reclaimed treated water for beneficial use or aquifer storage
- Native vegetation requiring little or no irrigation (regrading, vegetative caps, etc)
- Prevention of water quality impacts such as nutrient-loading

Core Elements: Land and Ecosystems

- Minimally invasive in situ technologies
- Passive energy technologies as primary remedies or “finishing steps”
- Minimal soil and habitat disturbance
- Adoption of ecorestoration and reuse practices
- Reduced noise and lighting disturbance

Core Elements: Material Consumption and Waste Generation

- Technologies designed to minimize waste generation
- Reuse and recycling of materials, including C&D debris
- Minimized extraction and disposal of natural resources
- Passive sampling devices producing minimal waste

Core Elements: Long-Term Stewardship

- Reduced emission of CO_2, methane, and other greenhouse gases
- Adaptive management approach integrated into long-term actions and redevelopment
- Renewable energy systems for long-term cleanup and future economic benefit
- Leverage of remedy infrastructure for reuse

Core Elements: Energy Requirements

- Energy efficient equipment operating at peak performance
- Periodic evaluation and optimization of equipment with high energy demand
- Renewable energy systems to replace or offset grid electricity
- Managed demand to leverage low peak capacity and rates

Carbon & Energy Footprints of Superfund Cleanup Technologies

Technology	Estimated Energy *Annual Average* (kWh*10^3)	Total Estimated Energy Use *in 2008-2030* (kWh*10^3)
Pump & Treat	489,607	11,260,969
Thermal Desorption	92,919	2,137,126
Multi-Phase Extraction	18,679	429,625
Air Sparging	10,156	233,599
Soil Vapor Extraction	6,734	154,890
Technology Total	*618,095*	*14,216,209*
Sum of 5 Technologies	**Annual Carbon Footprint (MT CO2)** 404,411	

Recap on Energy & Carbon Footprint Strategy

- Optimize systems to maximize efficiency and return per unit energy invested
- Build renewable energy capacity at contaminated sites to power remedies
- Tap into grid renewable energy portfolios
- Leverage carbon sequestration from soil amendment treatment (policy vacuum)

Green Remediation Profile: Ferdula Landfill, Frankfort NY

- Soil vapor extraction relying on wind power to draw vacuum from landfill vents
- Exclusively off-grid operations providing a pulsed effect for carbon removal of VOCs
- VOC concentrations in soil gas reduced over 90% in five years of operation

Green Remediation Profile: Operating Industries Landfill, Monterey Park CA

- Meets about 70% of plant needs (thermal oxidizer, refrigeration, and air blower)
- Six 70-kW microturbines for landfill gas collection (5,500 scfm) at Superfund site
- Savings reaching up to $400,000 each year through avoided grid electricity

Green Remediation Profile: St. Croix Alumina, St. Croix VI

- PV panels generating electricity for fluid-gathering system during oil recovery
- Wind-driven turbine compressors and electric generators powering pumps to recover free-product oil
- Reclaimed oil from RCRA site used for refinery feedstock

"OSWER" Green Remediation Strategy

For the purpose of advancing green remediation best practices across cleanup programs OSWER seeks to:

- Benchmark and document GR best management practices
- Assemble a toolkit of enablers
- Build networks of practitioners
- Develop performance metrics and tracking mechanisms

Why a "Strategy"

- A common understanding for better internal communication
- A unified EPA voice and position when working with regulated parties
- Developing shared goals to better measure and communicate progress
- Leverage similar efforts with other organizations (ITRC, SERDP, ASTSWMO, FRTR, etc).

What About the NCP?

Potential Intersection of NCP Criteria and Green Remediation Core Elements

NCP Criteria	Sub-Criteria	Energy		Air		Water		Land & Ecosystems			Materials & Waste		Long-Term Stewardship	
		Remedial Process Optimization	Renewable Energy	GHG	PM10	Water Conservation	Waster Quality Enhancement	Land Use	Ecosystems	Transfer vs. Destruction	Waste Reduction	Recycling and Reclaiming	Adaptive Management	Community Involvement
Protection of Human Health and the Environment	Protection of the Human Health and the Environment	I	I	I	I	I	I	I	I	I	I	I	I	I
Compliance with ARARs	Compliance with Chemical-Specific ARARs													
	Compliance with Action-Specific ARARs													
	Compliance with Location-Specific ARARs									I				
	Compliance with Other Criteria, Advisories, and Guidances									I				
Long-Term Effectiveness	Magnitude of Residual Risk									I				
	Adequacy and Reliability of Controls									I				
	Treatment Process Used and Materials Treated													
Reduction in Toxicity, Mobility, and Volume	Amount of Hazardous Materials Destroyed or Treated													
	Degree of Expected Reductions in Toxicity, Mobility, and Volume													
	Degree to Which Treatment is Irreversible													
	Type and Quantity of Residual Remaining After									I	I	I	I	
Short-Term Effectiveness	Protection of Community During Remedial Actions							I	I					
	Protection of Workers During Remedial Actions													
	Environmental Impacts	I	I	I	I	I	I	I	I	I	I	I		
	Time Until Remedial Action Objectives are Achieved							I	I					
Implementability	Availability to Construct and Operate the Technology													
	Reliability of the Technology													
	Ease of Undertaking Additional Remedial Actions, if Necessary	I												
	Ability to Monitor Effectiveness of Remedy	I												
	Ability to Obtain Approvals From Other Agencies	I	I											
	Coordination with Other Agencies												I	
	Availability of Offsite Treatment, Storage, and Disposal Services/Capacity													
	Availability of Necessary Equipment and Specialists													
	Availability of Prospective Technologies		I											
Cost	Capital Cost	I												
	Operating and Maintenance Costs	I	I											
	Present Worth Cost	I												
State Acceptance	State Acceptance												I	I
Community Acceptance	Community Acceptance				I	I	I	I	I				I	I

Developed from a draft chart prepared by CDM, as presented at the "Battelle" Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds 2008

I Potential Intersection under NCP Authority (40 CFR Part 300)

RCRA Remedy Selection Criteria

Threshold Criteria

- Protect Human Health & the Environment
- Control Sources
- Meet Cleanup Objectives

Balancing Factors

- Long-term reliability
- Reduction of toxicity, mobility or volume
- Short-term effectiveness
- Ease of implementation
- Cost
- Community acceptance
- State acceptance
- Sustainability

The Green Remediation Toolkit

Existing

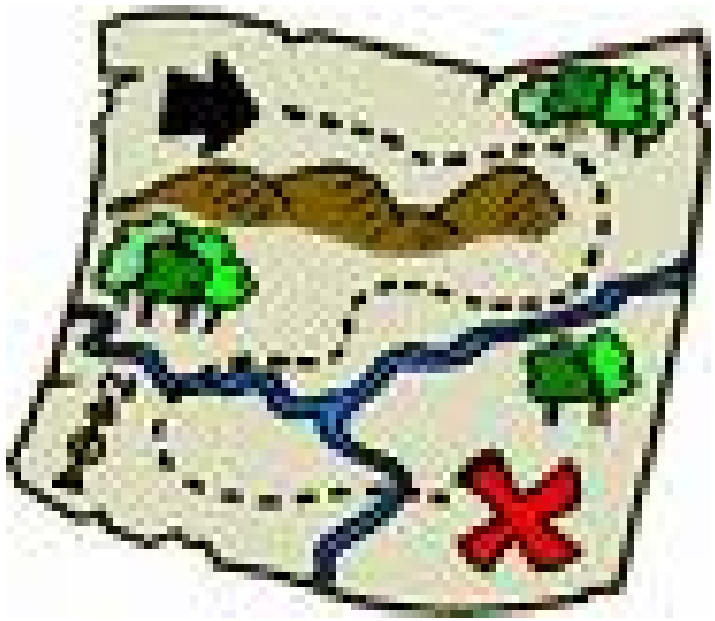
- Green remediation primer
- Profiles of projects and case studies on EPA green remediation site
- Upcoming internet seminars, and archived discussions (cluin.org)
- Green remediation tech support for Federal and State project managers
- Contracts toolkit for RACs

In the pipeline

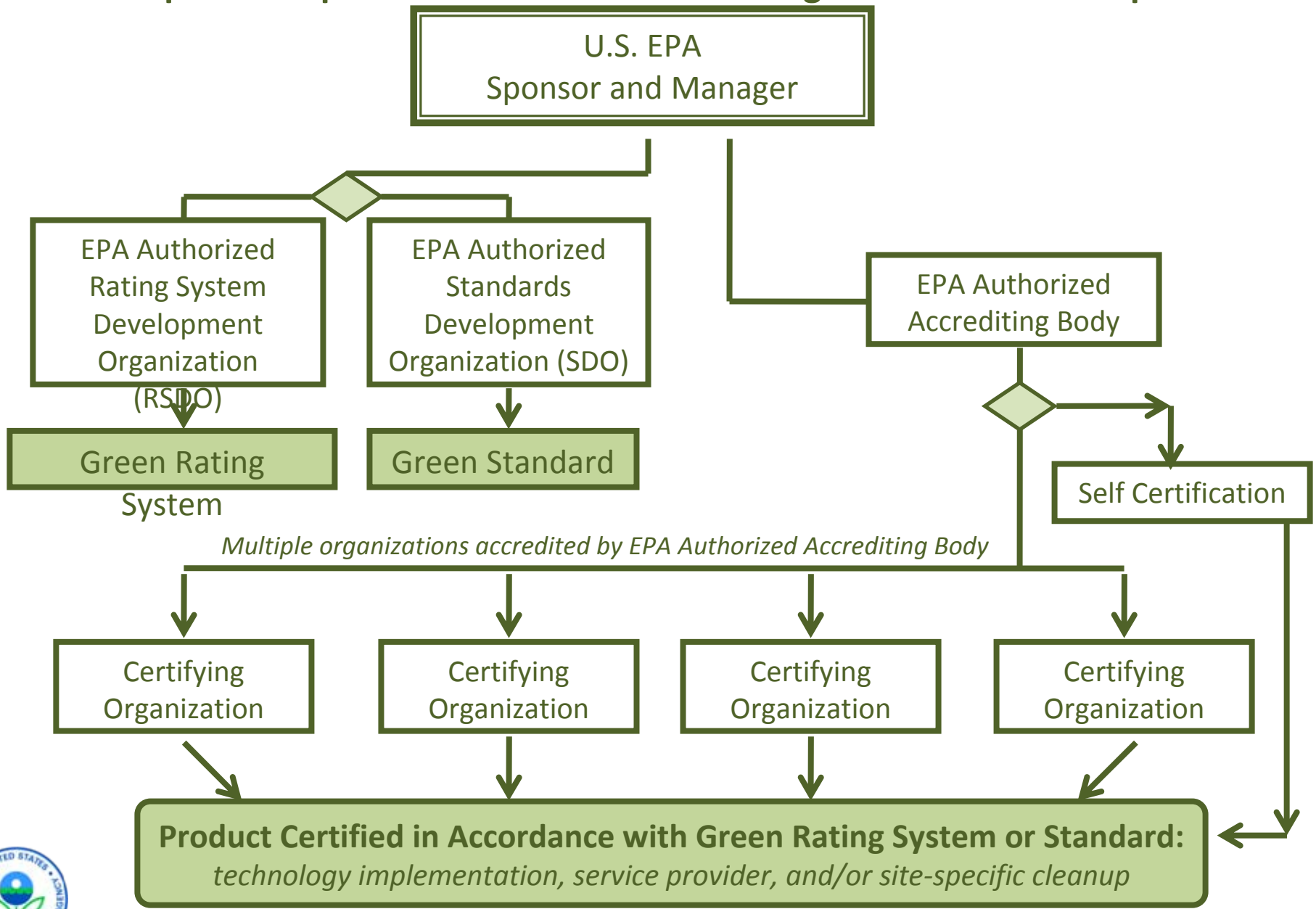
- MOU with NERL
- MOU with the USACE recognizing and fostering GR BMPs at Superfund cleanups
- Contracts toolkit for ERRS
- Green remediation certification program
- Remedy specific green remediation “cheat sheets’
- Site cleanup energy audit tool
- Who’s who in green remediation (EPA Intranet)
- ER3 for Green remediation

Green Cleanups Certification: Conceptual Paper

- What are we certifying?
  - » Projects
  - » Individuals
- What does the structure look like?
  - » Leed (rating system)
  - » ISO 14000 (management system)
  - » Other
- Who is the certifier?
  - » Self certification (audits)
  - » 3rd party
- What are the incentives?
  - » Monetary
  - » Emotional
  - » Branding
- What is our approach for a consensus developing process
  - » Standards Developing Organization
  - » Non-profit

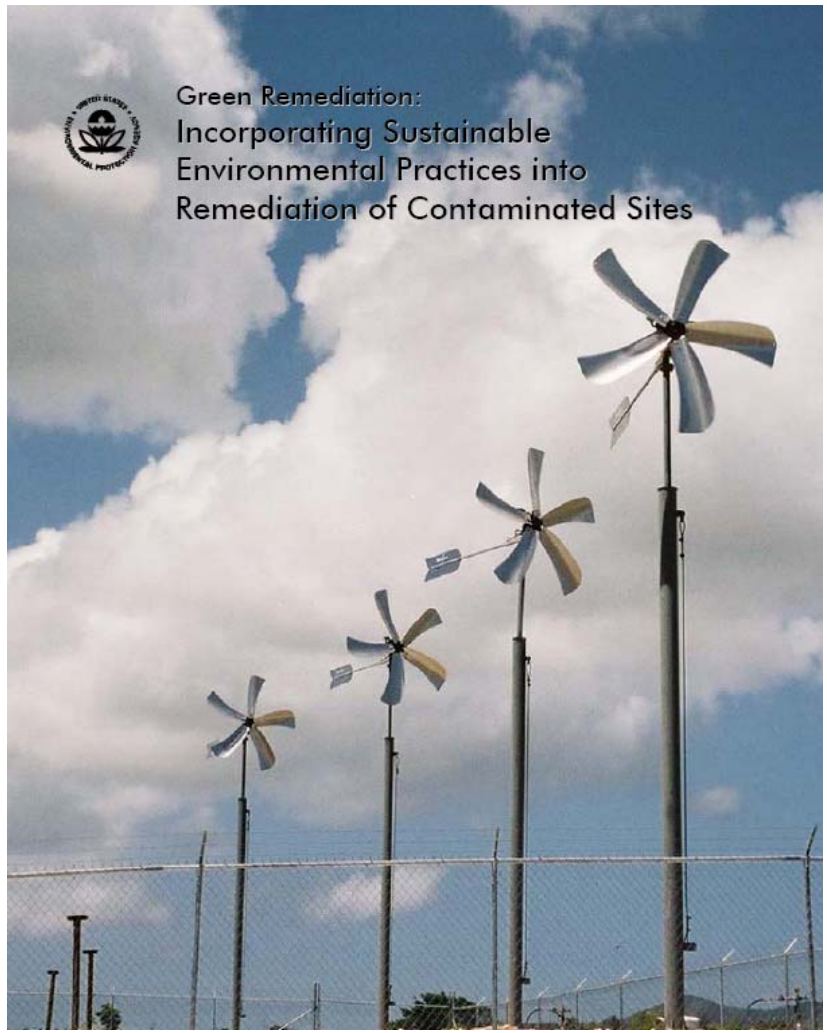


Sample Conceptual Structure of a Green Program for Site Cleanups



EPA Green Remediation Primer

- Provides introduction to best practices with examples of how and where they are used
- Focuses on remedy implementation across regulatory frameworks
- Released April 2008, available at: http://cluin.org/greenremediation



Green Remediation on the Web

www.clu-in.org/greenremediation